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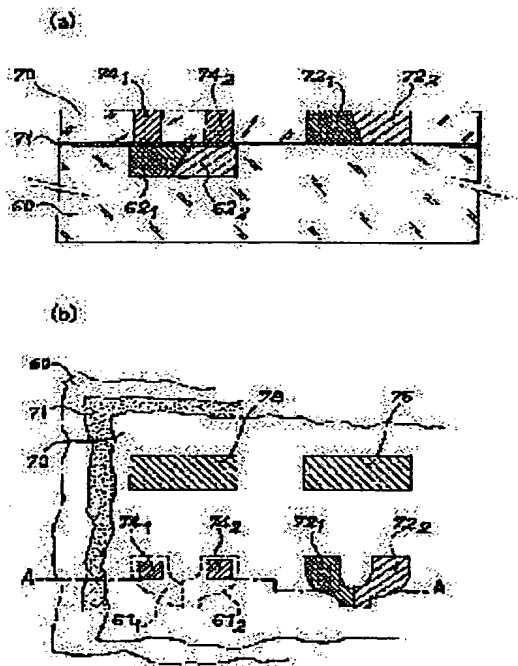
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(54) MANUFACTURING PROCESS FOR ASSEMBLY HAVING PLURAL MAGNETIC HEADS AND MULTI-HEAD ASSEMBLY OBTAINED BY ITS PROCESS

(57)Abstract:

PROBLEM TO BE SOLVED: To highly accurately manufacture an assembly having plural magnetic heads at a low manufacturing cost.

SOLUTION: A sub-assembly having magnetic pole pieces 621, 622, separated from each other through a gap is formed on a base material 60 and magnetic pole pieces 721, 722 separated from each other through a gap and magnetic connectors 741, 742 arranged in parallel with them and consisting of a magnetic material are formed on a base material 70. In order to secure magnetic continuity, one of the base materials 60, 70 is inverted and combined with the other base material so that the connectors 741, 742 on the base material 70 are brought into contact with the pieces 621, 622 on the base material 60, and then the base material 70 is thinned until the pieces 721, 722, and the connectors 741, 742 are exposed. A magnetic circuit for mutually connecting the connectors 741, 742, a reading/writing means magnetically connected to the magnetic circuit, a magnetic circuit for mutually connecting the pieces 721, 722, and a reading/writing means magnetically connected to the magnetic circuit are formed on the thinned base material 70.



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CLAIMS

[Claim(s)]

[Claim 1] The process characterized by providing the following. It is the manufacture process of an assembly of having two or more magnetic heads, and is - Operation which forms at least one subassembly possessing 1st at least two pole piece (621,622) which was separated by the 1st gap (63) in each case on the 1st base material (60). - 2nd at Least Two Pole Piece Which was Separated by 2nd Gap (73) on 2nd Base Material (70) in Each Case (721,722) Operation which forms at least two magnetic connectors (741,742) which are formed of a magnetic material and arranged together with two of the 2nd pole pieces (721,722) of the above. - So that Magnetic Continuity May be Secured Two Magnetic Connectors (741,742) of 2nd Base Material (70) of Above the 1st two pole piece (621,622) of the 1st base material (60) of the above, and contact - - or so that it may almost come to contact The operation which reverses one side of the aforementioned base materials (60 70), and is combined on other base materials (70 60), - 2nd Pole Piece (721,722) of above and the Aforementioned Magnetic Connector (741,742) Exposure or Operation Which Makes Thin 2nd Base Material (70) of above until it Almost Exposes, - 1st Magnetic Circuit Which Connects Two Magnetic Connectors (741,742) on 2nd Base Material (70) of above Which Did in this Way and was Made Thin, The 1st read-out and/or write-in means (801,802) which were magnetically combined with this 1st magnetic circuit, Operation which forms the 2nd magnetic circuit which connects the 2nd two aforementioned pole piece (721,722), and the 2nd read-out and/or write-in means (901,902) which were magnetically combined with this 2nd magnetic circuit.

[Claim 2] the aforementioned read-out of the 1st and/or a write-in means -- the 1st conductor -- a coil (801,802) -- it is -- the aforementioned read-out of the 2nd and/or a write-in means - - the 2nd conductor -- the process according to claim 1 characterized by being a coil (901,902)

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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[The technical field to which invention belongs] This invention relates to the multi-head assembly obtained according to the manufacture process and this process of the assembly which has two or more magnetic heads. Especially, as a desirable use, generally, although well-known video videotape recording is visualized, it can use also in other fields like data backup or a computer memory.

[0002]

[Description of the Prior Art] The magnetic record carrier for video videotape recording, data backup, and computer memories possesses many trucks with which information is written in with the gestalt of a magnetic domain. In order to increase informational density, the number not only of the number of the information per unit length but trucks is increased. The width of face of a truck is reduced for this purpose, and simultaneously, the gap which has divided them is reduced until a truck adjoins.

[0003] In order to avoid the problem of the cross talk in the case of read-out, information is written in two adjoining trucks at the angle which inclined with the degree of tilt angle of opposite direction. This degree of tilt angle is known as an azimuth. The gap of the magnetic head must have the direction of the value which is in agreement with the inclination of record.

[0004] Therefore, the write-in direction which appended drawing 1 shows the record carrier which has two trucks 10a and 10b, and was determined by the gap, and was shown with the gestalt of an inclination line is making the angle -1 from the perpendicular direction to an angle $+1$ and truck 10b to truck 10a to the direction of an outline of a truck.

[0005] Appended drawing 2 shows the two magnetic heads 12a and 12b which have the gaps 14a and 14b which have the azimuth of $+1$ and -1 , respectively. The move direction of a head is shown by Sign D.

[0006] In fact, it is not the gestalt of two heads arranged in parallel as the assembly of the head of two ***** with a direction generally indicated to be to opposite direction at drawing 2. Otherwise, the truck read is because it does not adjoin. It is in the gestalt of two heads which the variation rate was carried out or were offset mutually at the longitudinal direction, as shown in drawing 3. It is possible to narrow a truck by this arrangement. In this arrangement, each of two heads 16a and 16b had the gap where direction attachment of full [L] was carried out, and it is separated [from two gaps] of distance T. Each head can skim [truck / readout / of width of face e], and the aforementioned truck touches in false. The overlap of a head is shown by r.

[0007] the distance between two trucks recorded at the record period P, i.e., the same direction, in order to write a direction in the truck which it is turned to opposite direction, and is the same width of face, and adjoins -- crossing -- L, r, and e -- relational-expression $P=2(L-r)=2e$ or -- It is required to be connected by $r=L-P/2=L-e$. For example, although $r=1$ micrometer is obtained to $e=5$ micrometers and $L=6$ micrometers to $P=10$ micrometers, it is clear that $L=e$ and $r=0$ can be chosen.

[0008] In the case of the head which has the width of face L1 and L2 of a different pole (pole), a record period is equal to $P=L1+L2-r-r'$. It is the overlap according [accord / the width of face of

the pole of a head 1 / L1 / in the width of face of the pole of a head 2, and $r' / L2$] to a system parameter here.

[0009] Though it has the width of face of the pole where heads differ by operation of r and r' , two written-in tracks of the same width of face can be found. The fact of having the head of different **** is an interesting thing in order to make tolerance severe in one side of the two heads as a parameter for adjusting reluctance of many reasons, i.e., two heads, (it having the efficiency which can be contrasted like).

[0010] The two magnetic heads 16a and 16b also possess a means like the coil of the conductor magnetically combined with the magnetic-flux closed circuit and this magnetic circuit which connect one pole piece to other pole pieces which is not illustrated. The assembly of all these means forms the double head which has the opposite direction roughly shown with the sign 18 in drawing 3. The direction of the variation rate is shown by Arrow D.

[0011] In order to obtain such a double head, two separate heads which generally have the gap which inclined in opposite direction are manufactured, and a single base material is equipped with these two heads. the direction attachment **** magnetic head is shown by the method embodied to drawing 4 (in cross section) In drawing 4, the single crystal base material 20 and two pole pieces 221,222 separated by the magnetic gap 24 toward which only the angle i inclined can be seen. This inclination is obtained by taking in the advantage of the property of the single crystal of a base material, and etching an anisotropy according to the crystal face of a base material. This process is indicated by the French country patent application public presentation No. 2664729 official report (or the [international public presentation] 92/02015 official report).

[0012] Since two single heads are reconfigured, the double head manufacture process of a bird clapper is not completely satisfactory. Therefore, it is difficult to orient two heads correctly so that those gaps may have a desired direction in each ****, and it is also difficult [it] to arrange two heads correctly to mutual so that each of two heads may collaborate in a track and accuracy. Width of face of 6.7 microns shows the size given in relation to drawing 3, and that it is the problem of a very precise setup or regulation further to the detail.

[0013] The French country patent application public presentation No. 2747226 official report is indicating other processes for manufacturing the assembly which has the two magnetic heads of the direction which counters. The example of a changed completely type of this process is shown in drawing 5 and 6.

[0014] Drawing 5 shows generally the header A which has the 1st head by the reference mark 100. the magnetic circuit in which this header A has eclipse ***** with a direction, and a conductor — it has the assembly possessing a coil and two pieces 1041 and 1042 of contact It ranks with the aforementioned head and the slot 120 where it *****ed in the 1st is formed.

[0015] the magnetic circuit which has the same eclipse ***** with a direction as the same means, i.e., the gap of the 1st head 102, in the header B of an opposite side, and a conductor — the 2nd head 130 which has the assembly 132 possessing a coil and the pieces 1341 and 1342 of contact is formed The 2nd slot 140 is formed together with the 2nd head 130.

[0016] If the header B of an opposite side is reversed on Header A, the 1st head 100 will be inserted in in the 2nd slot 140, the 2nd head 132 will be inserted in in the 1st slot 120, and an assembly will be obtained in the state where it was combined together, after that. The result is shown in drawing 6 in graph. In this drawing 6, the 1st head 102 which has eclipse ***** g1 with a direction is arranged on a base material 150, and it is covered with the insulating layer 160, and the 2nd head 142 which has eclipse ***** g2 with a direction in opposite direction can see being accompanied by the reversed base material 150 and its insulating layer 160. Two pieces of contact are inserted mutually. Since they are complementary to mutual, they constitute the head of one.

[0017]

[Problem(s) to be Solved by the Invention] Although it is satisfactory in many points, this process has some faults still more. Therefore, it turns out [rather than] that it is [the thing] more suitable for the assembly by the header to the process which gathers this process on the whole. Therefore, it is difficult to control several microns etching by tolerance 1 micron or less

on an already very complicated stack on a perfect flat surface. Furthermore, the electric connection between two heads is difficult. Since connection of two heads in a part for a vertical section is not perfect, it may produce dirt (dirtying). Finally, the cost of this kind of double head is at least 4 times as compared with a single head. The purpose of this invention is preventing these faults. This invention aims not only at a double head but at the thing more generally acquired for many heads.

[0018]

[Means for Solving the Problem] For this purpose, the coil and the coil were manufactured but [not before reversal] after reversal, and this invention has proposed the process which solves the problem of the contact reproduction (contact renewal) by it, although operation is performed by reversing one side on another side once again. Moreover, technology is simplified and the amount of [of the assembly with which an adhesive joint produces a problem] vertical section is made to disappear by avoiding deep etching of the slot in a base material. Finally, a manufacturing cost is reduced by leaps and bounds by using common technology to both subassemblies.

[0019] These purposes are attained by this invention by the following methods.

– On 1st Base Material, 1st at Least One Subassembly Possessing 1st at Least Two Pole Piece Divided into Each **** by 1st Gap is Formed. – 2nd at Least Two Pole Piece Separated by Each **** by 2nd Gap on 2nd Base Material, It is arranged together with two of these 2nd pole pieces, and 2nd at least one subassembly possessing at least two magnetic connectors formed from the magnetic material is formed. – One Side of the Aforementioned Base Material the Magnetic Aforementioned Two Connectors of 2nd Base Material of Above That a magnetic continuity should be secured, it is reversed by the 1st two pole piece on the 1st base material, contact, or the method that it comes to contact mostly, and combines on another side. – 2nd Pole Piece of above, and the Aforementioned Magnetic Connector — Exposure — or — until it Almost Exposes — 2nd Base Material of above — Thin — Carrying Out — With 1st Magnetic Circuit Which Connects Two Magnetic Connectors on 2nd Base Material Which Did in this Way and was Made Thin The 1st read-out and/or write-in means which were magnetically connected to the 1st circuit of the above, the 2nd magnetic circuit which connects two pole pieces, and the 2nd read-out and/or write-in means which were magnetically connected to this 2nd magnetic circuit are formed.

[0020] It is not necessarily required to be directly in contact with the magnetic element of the 1st and 2nd base materials. Although an insulating layer may exist among these elements, in order to secure a magnetic continuity, a thing thin (for example, thinner than 1 micrometer) enough is required for it. Since this insulating layer enables reduction of the effect by the magnetic separation and magnetic eddy current between different elements, it is useful in a fixed use.

[0021] In a certain method, in case the 2nd base material is made thin, a thin insulating layer may be left behind on the 2nd pole piece and a magnetic connector. this insulating layer may be maintained, while being the remaining process, when the purpose is reducing the effect by the eddy current It is clear to place and ***** in the position of electrical installation, when this layer is what has electric insulation, and when it does not have electric insulation (i.e., when it is conductivity), in order to prevent a short circuit, you have to ***** [near the coil].

[0022] The base material of the SOI (silicon is carried on insulator) form which completes by epitaxy or has not been completed as an example relevant to manufacture of the aforementioned assembly can be used, SHININGU (thinning) is performed to the embedded insulating layer after that, and a magnetic element is manufactured in a thin semiconductor coat, for example, the coat of silicon.

[0023] According to 1 operation gestalt, the write-in means is constituted by the coil of a conductor. According to the 1st modification, a read-out means is also the coil of a conductor. according to the 2nd modification — a read-out means — magnetic reluctance — it is a member This magnetic-reluctance member is manufactured by method which is allotted to either of the magnetic leads (magnetic leads) of the back of a pole piece, a magnetic circuit, i.e., a posterior part pole piece, or a circuit. electrical installation — magnetic reluctance — it is clear

to ensure supply of a member

[0024] the 1st and 2nd magnetic circuits and the 1st conductor, in order to form the coil of the 2nd conductor, a coil and in existing Useful information is offered with the French country patent application public presentation No. 2747226 specification mentioned above, and according to it the up conductor layer over which the magnetic circuit and pole piece which close a lower conductor layer and a pole piece are built forms continuously — having — the meanses by which an up conductor layer is arbitrary — for example, a conductor — it connects with a lower conductor layer by using a connection element

[0025] If only a single subassembly is formed on each base material, the assembly which has the two magnetic heads will be obtained. When two subassemblies are formed on each base material, the assembly which has four heads is obtained. several [which has several p arbitrary subassemblies, respectively in order to obtain the assembly which has the head of np individual generally / arbitrary] — it is possible to use n base materials This invention relates also to the multi-head assembly obtained according to this process.

[0026]

[Embodiments of the Invention] Already explained drawing 1 shows two adjoining recording tracks. Already explained drawing 2 shows the head of two ***** with a direction to opposite direction. Already explained drawing 3 shows the assembly which has two offset heads. Already explained drawing 4 shows the detail of the head of well-known eclipse ***** with a direction. Already explained drawing 5 is the plan of a head, connection, and the piece of contact, and shows that which *****ed the header and the header of an opposite side according to the well-known process. Already explained drawing 6 shows the well-known double head assembly. (a) of drawing 7 and (b) are the cross sections and plans showing the 1st subassembly by 1 operation gestalt of this invention. (a) of drawing 8 and (b) are the 2nd cross section and plan of a subassembly by this invention. (a) of drawing 9 , and (b) — a conductor — it is the cross section and plan of an assembly which have two heads before manufacture of a coil, and synzesis of a magnetic circuit (a) of drawing 10 , (b), and (c) — a conductor — it is the plan showing three stages in closing manufacture and the magnetic circuit of a coil (a) of drawing 11 and (b) are the cross sections in a magnetic connector. Drawing 12 is a cross section in an electrical connector. (a) of drawing 13 and (b) are the plans showing the modification of the 1st which has four magnetic connectors, and 2nd subassemblies. Drawing 14 shows the corresponding assembly. Drawing 15 shows 1 operation gestalt in which one side of a posterior part pole piece has a central neck. Drawing 16 shows the specific operation gestalt which closes a magnetic circuit by assistance of the pole piece of the shape of single horseshoe shape. Drawing 17 shows the example of a changed completely type by which two base materials were mutually made in agreement slightly so that the overlap of the magnetic head may be generated. Drawing 18 is the cross section showing the assembly turned to the four magnetic heads and two opposite direction. Drawing 19 shows the outline of the process in the case of three base materials for obtaining the assembly which has the three magnetic heads, and three subassemblies.

[0027] In drawing 7 (a), by the cross section, drawing 7 (b) shows with the plan the 1st base material 60 which consists of silicon, and the 1st two pole piece 621,622 separated by the gap 63 which has a fixed direction. The cross section of drawing 7 (a) corresponds to the cutting plane line AA of drawing 7 (b).

[0028] With the cross section, drawing 8 (a) shows the 2nd base material 70 which has two magnetic connectors 741,742 which were constituted by the magnetic material with the 2nd pole piece 721,722 from which drawing 7 (b) was separated by the plan by two eclipse ***** 73 with a direction, and have been arranged along with the aforementioned pole piece 721,722 and two pieces 76 and 78 of posterior part magnetism and which consists of silicon, for example. The cross section of drawing 8 (a) corresponds to the cutting plane line BB which penetrates the aforementioned connector 741,742 in drawing 8 (b).

[0029] On the other hand, the 2nd base material is reversed for inside [it is two base materials]. This reversal is performed in the direction of after or the right to the left from before. Once reversal is performed, two base materials will be combined or will be arranged on

mutual. They are certainly carried out before double-sided printing so that it may be positioned mutually, for example, a tooth back may align, or they are directly carried out by infrared visualization. Thus, two base materials which aligned are attached by adhesion, anode coupling, or molecular binding.

[0030] The following operations show reduction or SHININGU out (thinning out) of the thickness of the 2nd base material 70 from a tooth back until the 2nd pole piece 721,722, magnetic connector 741,742, and pieces 76 and 78 of posterior part magnetism are exposed. In advance of incision (cleaving) etc., it is begun to delete this SHININGU out and it may be performed by polishing or implantation (implantation). As mentioned above, it is also possible to leave a thin insulating layer.

[0031] Thereby, the assembly which was shown to drawing 9 (a) by the cross section, and was shown in drawing 9 (b) with the plan is obtained. The cross section corresponds to the line AA which penetrates the contact element and the 2nd pole piece. These drawings show that it must be arranged by the way the magnetic connector 741,742 comes to contact the 1st pole piece 621,622 of the 1st subassembly, when two base materials are combined on mutual.

[0032] Drawing 9 (a) shows the alternative insulating layer 71 which separates two base materials, in order to reduce an eddy current, and magnetic contact of a different magnetic element is performed through this layer 71 after that.

[0033] then, two magnetic circuits are completed — making — a conductor — it is required to manufacture a coil these operations can be set on the conventional technology — like, before such a combination is performed, it is carried out to the assembly formed after a mutual combination of two base materials Various solutions are possible because of these operations, and drawing 10 (a), (b), and (c) show one of them.

[0034] According to drawing 10 (a), the 1st phase is forming the 2nd two lower conductor layer 901,902 behind a connector 741,742 the 1st two lower conductor layer 801,802 and behind the 2nd pole piece 721,722 in the 2nd base-material 70 top made thin or its interior.

[0035] On the 2nd base material 70, through the back magnetic piece 78, it is the foot 821,822 on which the 1st linked to the magnetic connector 742 of another side closed one magnetic connector 741 magnetically, and, according to drawing 10 (b), the foot 821,822 which overlaps the 1st lower conductor layer 801,802 is formed next. Then, the 2nd two foot 921,922 which connects one pole piece 721 to the pole piece 722 of another side and which was closed magnetically is formed through the back magnetic piece 76. These 2nd foot overlaps the 2nd lower conductor layer 901,902.

[0036] According to drawing 10 (c), the 2nd upper up conductor layer 941,942 of the two 1st [of the piece P of contact and the 1st lower conductor layer 801,802] upper up conductor layer 841,842 and the 2nd lower conductor layer is formed next. While the interconnection of the 1st lower conductor layer 801,802 and up conductor layer 901,902 is carried out electrically and they form the 1st coil, the interconnection of the 2nd lower conductor layer 901,902 and the 2nd up conductor layer 941,942 is carried out electrically, and they form the 2nd coil.

[0037] the conductor of a different layer — in order to make electric connection of a between, an electrical connector can be formed in the edge of the conductor of a lower conductor layer by method which the connector of an up conductor layer comes to connect together before the formation of a foot 821,822,921,922 whose electrical connectors of these have magnetism — or it may be formed after that

[0038] The cross section shows connection magnetic [drawing 11 and drawing 12] and electric. Drawing 11 shows the portion which connects the pole piece 621,622 in the magnetic connector 741,742 to the foot 821,822 which has magnetism in the cross section. For example, the insulating layers 83 and 85 which consist of SiO₂ have insulated these portions. A lower additional member covers the aforementioned assembly, and it is functioning as a protective layer.

[0039] Drawing 12 shows the portion which has the conductive connection elements 96 and 97 which connect the conductor of the lower conductor layer 801, and the conductor of the up conductor layer 841 in the cross section. In the illustrated modification, the 1st base material 60 does not only adhere to the lower conductor layer 801, instead it is embedded to the interior.

The slot which it *****s to a base material, and the hollow is filled up with the insulating material 98 for this purpose, and is filled with conductor material is formed.

[0040] Drawing 13 (a) and drawing 13 (b) are the plans showing other operation gestalten of the 1st and 2nd subassemblies. In addition to the 1st pole piece 621,622, on the 1st base material, the piece 200 of posterior part magnetism is formed. In addition to the 2nd pole piece 721,722 and magnetic connectors 2041 and 2042, on the 2nd base material, the piece 202 of posterior part magnetism and the 2nd magnetic connector 2061 and 2062 are formed.

[0041] After reversing the 2nd base material and combining it on the 1st base material, an assembly as (to or the reverse) shown in drawing 14 is obtained. While the 1st connector 2041 and 2042 continues being supported on the 1st pole piece 621,622, the 2nd connector 2061 and 2062 is supported on the piece 200 of posterior part magnetism of the 1st base material.

[0042] Therefore, it is required to close the 1st magnetic circuit with two foot which connects connectors 2041 and 2061 and connectors 2042 and 2062. In order to close the 2nd magnetic circuit, the foot which has two magnetism is formed between a pole piece 721,722 and the piece 202 of posterior part magnetism. A coil may be simultaneously formed, as explained in relation to (a) - (c) of drawing 10 .

[0043] According to explanation of many operation gestalten, it is clear that the 1st magnetic circuit for the 1st magnetic head completes the magnetic element (namely, the 1st pole piece and if suitable posterior part closing piece) of the 1st subassembly according to those combination on reversal of the 2nd base material and the 1st base material only by the magnetic connector which it has in the upper surface of the 2nd base material after being made thin. Since the aforementioned pole piece will become the same height as the front face of the 2nd base material once the 2nd base material is made thin about the 2nd magnetic circuit for the 2nd magnetic head, it is not necessary to supply a connector and may be completed by bringing directly on the 2nd pole piece.

[0044] Existence of the connector in the 1st magnetic circuit and such un-existing [of a connector] in the 2nd magnetic circuit will lead to the fixed asymmetry in a head. In order to compensate these effects, the posterior part closing piece of the magnetic flux of the 2nd head differs from the 1st thing for a while. Therefore, drawing 15 shows that the 1st circuit containing the 2nd connector 1041 and 1042 and the right-hand side piece 200 of posterior part magnetism has two necks 205,207 which make the 2nd magnetic circuit balance to the 1st magnetic circuit.

[0045] Of course, invention explained in the above is not limited when a magnetic circuit is closed by the foot and the piece of a posterior part of-like [parallelepiped]. The arbitrary magnetic pieces which make it possible to connect with the thing of the others of the connectors one or the pole piece of others one of the pole pieces can be used. For example, drawing 16 shows the piece 212 of-like [horseshoe shape] which carries out the direct file of the pole piece 2101 to a pole piece 2102. As for this piece 212 of-like [horseshoe shape], being manufactured from the isotropic magnetic material is desirable.

[0046] In the operation gestalt explained in the above, two base materials have a flat front face, and the variation rate of the two magnetic heads which will be obtained if one side of the base materials is combined on another side is mutually carried out nothing in any duplications (the duplication section tau shown in drawing 3) among them. However, such duplication can be easily obtained by *****ing a step to each base material as shown in drawing 17 . The step (kink) obtained is shown by the sign 220.

[0047] Although the idea that the problem of the conventional technology generates such a step by *****ing also comes out, that is not right in this case. In the process indicated by the French country patent application public presentation No. 2747226 official report mentioned above, the step in a base material to which it *****ed is a problem which only generates the minute variation rate between the flat surfaces of a base material to having the height exceeding 10 micrometers here, and the variation rate does not exceed about 2 micrometers. The aforementioned etching may be controlled by accuracy (0.1-micron tolerance) in order to obtain the depth restricted very much.

[0048] This invention is not limited to a double head assembly, is replaced with this, and spreads even in the arbitrary assemblies possessing the head of an arbitrary number. For example,

drawing 18 shows 4 head assembly. The assembly 230 possesses two heads 241,242 which have the pole piece which has the direction where the two same heads 231,232 which have those magnetic connectors for those pole pieces that have eclipse ***** with a direction and these heads 231,232 are opposite.

[0049] It shall have three base materials as the process concerning this invention not limited to equipment of two base materials, either, replaced it with this and they indicated to be to drawing 19. For this purpose, at least one subassembly possessing 1st at least two pole piece PP1 and PP2 separated by the 1st gap of a magnetic element is formed on the 1st base material S1.

[0050] 2nd at least two pole piece PP2 and PP2' which were separated by the 2nd gap on the 2nd base material S2, 2nd at least one subassembly possessing at least two magnetic connectors PR 2 which were manufactured from the magnetic material and have been arranged together with the piece PR 2 of the magnetism of ** a 2nd and two aforementioned PR2', and PR2' of a magnetic element is formed.

[0051] 3rd at least two pole piece PP3 and PP3' which were separated by the 3rd gap on the 3rd base material S3, The 3rd pole piece PP3, the 1st magnetic connector (PR3) 1 arranged together with PP3', and 1(PR3) ', this — the 2nd two magnetic connector (PR3) 2 arranged between the 1st magnetic connector (PR3) 1, 1(PR3) ', and the 3rd pole piece PP3 and PP3' and 3rd at least one subassembly possessing 2(PR3) ' of a magnetic element are formed

[0052] The 2nd base material S2 is the way two magnetic connectors PR 2 of the 2nd base material S2 and PR2' come to contact magnetically the 1st two pole piece PP1 of the 1st base material S1, and PP1', and is combined on the 1st base material S1. the 2nd base material S2 — the magnetic circuit PR 2 of the 2nd pole piece PP2, PP2', and the above 1st, and PR2' — exposure — or it is made thin until it almost exposes

[0053] The 3rd base material S3 the 1st two magnetic connector (PR3) 1 of the 3rd base material S3 and 1(PR3) ' It comes to contact magnetically two magnetic circuits PR 2 of the 2nd base material S2, and PR2'. It is combined on the 2nd base material S2 made thin by the 2nd two magnetic connector (PR3) 2 and the way 2(PR3) ' comes to contact the 2nd pole piece PP2 of the 2nd base material S2, and PP2'.

[0054] the 3rd base material S3 — the 3rd pole piece PP3, PP3', the 1st two connector (PR3) 1, 1(PR3) ' and the 2nd connector (PR3) 2, and 2(PR3) ' — exposure — or it is made thin until it almost exposes

[0055] thus, with the 1st magnetic circuit boiled and connected to the 3rd base material, if made thin The 1st read-out and/or write-in means like a coil are formed. for example, the 1st conductor magnetically combined with the 1st magnetic circuit — The 2nd magnetic circuit which connects the 2nd one magnetic connector (PR3) 2 and other magnetic connector (PR3) 2', for example, the 2nd conductor magnetically combined with the 2nd magnetic circuit — the 2nd read-out and/or write-in means like a coil being formed, and with the 3rd magnetic circuit which connects the 3rd one pole piece (PP3) and other pole pieces (PP3') for example, the 3rd conductor magnetically combined with the 3rd circuit of the above — the 3rd read-out and/or write-in means like a coil are formed

[0056] Although it is understood that the word of "magnetic contact" means either of the direct or indirect contact, it is enough in order to secure a magnetic continuity. This process may be generalized by n base materials. On the 1st base material, 1st at least one subassembly possessing 1st at least two pole piece separated by the 1st gap of a magnetic element is formed.

[0057] On the 2nd base material, 2nd at least one subassembly possessing 1st at least two magnetic connector which was formed of the magnetic material with 2nd at least two pole piece separated by the 2nd gap, and has been arranged together with two of the 2nd pole pieces of the above of a magnetic element is formed. This is continued over the base material of an individual (n-1) to n which is the larger natural number than 3.

[0058] On the n-th base material, n-th at least one subassembly possessing n-th at least two pole piece separated by the n-th gap, the 1st two magnetic connector, the 2nd two magnetic connector, and the magnetic connector of two ** (n-1) of a magnetic element is formed.

[0059] The 2nd base material is combined on the 1st base material by the way two connectors

of the 2nd base material come to contact magnetically the 1st two pole piece of the 1st base material. the 2nd base material -- the 2nd pole piece of the above, and the magnetic connector of the above 1st -- exposure -- or it is made thin until it almost exposes

[0060] This is continued to the n-th base material. the n-th base material The 2nd magnetic connector of this n-th base material contacts magnetically the 1st two connector of the base material of $** (n-1)$. The 2nd two magnetic connector of the n-th base material contacts magnetically the 2nd two connector of the base material of $** (n-1)$. It is combined on the base material of $** (n-1)$ made thin by the way the connector of $****$ and two $** (n-1)$ of the n-th base material comes to contact magnetically two pole pieces of the base material of $** (n-1)$. the n-th base material -- the n-th pole piece of the above and the above 1st, the 2nd, and the magnetic connector of $** (n-1)$ -- exposure -- or it is made thin until it almost exposes

[0061] The 1st magnetic circuit which connects the 1st one magnetic connector to other magnetic connectors on the n-th base material, for example, the 1st conductor magnetically combined with the 1st magnetic circuit of the above -- the 1st read-out and/or write-in means like a coil being formed, and the 2nd one magnetic connector with the 2nd magnetic circuit linked to other magnetic connectors The 2nd read-out and/or write-in means like a coil are formed, and it is made to be the same as that of the following. for example, the 2nd conductor magnetically combined with the aforementioned magnetic circuit -- the n-th magnetic circuit which connects the n-th one pole piece to other n-th pole piece, and the n-th conductor magnetically combined for example, with the n-th magnetic circuit of the above -- the n-th read-out and/or write-in means like a coil are formed therefore, the obtained assembly -- n magnetic circuits and n conductors -- the n magnetic heads which have n read-out and/or the write-in means like a coil are provided

[Translation done.]

*** NOTICES ***

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1.This document has been translated by computer. So the translation may not reflect the original precisely.

2.**** shows the word which can not be translated.

3.In the drawings, any words are not translated.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] Two adjoining recording tracks are shown.

[Drawing 2] The head of two ***** with a direction is shown in opposite direction.

[Drawing 3] The assembly which has two offset heads is shown.

[Drawing 4] The detail of the head of well-known eclipse ***** with a direction is shown.

[Drawing 5] It is the plan of a head, connection, and the piece of contact, and etching of the header according to a well-known process and the header of an opposite side is shown.

[Drawing 6] The well-known double head assembly is shown.

[Drawing 7] (a) and (b) are the cross sections and plans showing the 1st subassembly by 1 operation gestalt of this invention.

[Drawing 8] (a) and (b) are the 2nd cross section and plan of a subassembly by this invention.

[Drawing 9] (a) and (b) — a conductor — it is the cross section and plan of an assembly which have two heads before manufacture of a coil, and synizesis of a magnetic circuit

[Drawing 10] (a), (b), and (c) — a conductor — it is the plan showing three stages in closing manufacture and the magnetic circuit of a coil

[Drawing 11] (a) and (b) are the cross sections in a magnetic connector.

[Drawing 12] It is a cross section in an electrical connector.

[Drawing 13] (a) and (b) are the plans showing the modification of the 1st which has four magnetic connectors, and 2nd subassemblies.

[Drawing 14] The corresponding assembly is shown.

[Drawing 15] 1 operation form in which one side of a rear pole piece has a central neck is shown.

[Drawing 16] The specific operation gestalt which closes a magnetic circuit by assistance of the pole piece of the shape of single horseshoe shape is shown.

[Drawing 17] The example of a changed completely type by which two base materials were mutually made in agreement slightly is shown so that the overlap of the magnetic head may be generated.

[Drawing 18] It is the cross section showing the assembly turned to the four magnetic heads and two opposite direction.

[Drawing 19] The concept of the process in the case of three base materials for obtaining the assembly which has the three magnetic heads, and three subassemblies is shown.

[Description of Notations]

60 1st Base Material

621,622 The 1st pole piece

63 1st Gap

70 2nd Base Material

721,722 The 2nd pole piece

73 2nd Gap

741,742 Magnetic connector

76 2nd Piece of Posterior Part Magnetism

78 1st Piece of Posterior Part Magnetism

801,802 The 1st read-out and/or write-in means (1st conductor a coil, the 1st lower conductor layer)
821,822 1st magnetic closed circuit (1st magnetic leg)
841,842 1st up conductor layer
901,902 The 2nd read-out and/or write-in means (2nd conductor a coil, the 2nd lower conductor layer)
921,922 2nd magnetic closed circuit (2nd magnetic leg)
941,942 2nd up conductor layer
96 97 Electrical connector
131,132 The 1st subassembly
141,142 The 2nd subassembly
200 1st Piece of Posterior Part Magnetism
202 2nd Piece of Posterior Part Magnetism
2041 2042 1st magnetic connector
2061 2062 2nd magnetic connector
2101 2102 The 2nd pole piece
212 Magnetic Piece of-like [Horseshoe Shape]
231,232 The 1st subassembly
241,242 The 2nd subassembly
S1 The 1st base material
S2 The 2nd base material
S3 The 3rd base material
PP1, PP1' The 1st pole piece
PP2, PP2' The 2nd pole piece
PP3, PP3' The 3rd pole piece
1 (PR3) 1(PR3) ' 1st magnetic connector
2 (PR3) 2(PR3) ' 2nd magnetic connector

[Translation done.]